

Unit5: Basidiomycota

Class- Ustilaginomycetes

Order-**Ustilaginales (Smut fungi)**

### *Ustilago* (**Smut fungi**)

The members of the order Ustilaginales are commonly known as **smut fungi**. Among the Heterobasidiomycetes only the smuts and rusts do not produce basidiocarp. The smuts get their name from the sooty appearance of their sori, which are filled loosely with dark-brown or black, dust-like, thick walled teliospores.

Most of the species of *Ustilago* are parasitic on plants, causing destructive smut disease of many cereal grains including wheat, barley, maize and rice. They are not strictly obligate parasites as they can be grown on artificial culture media.

The masses of spores (sori) are usually black and dusty containing smut spores, which are also known as black spore, chlamydospore, resting spores or teliospores.

All the species of *Ustilago* complete their life cycle on one host and thus are called the **autoecious** parasite.

The smuts have a simpler life cycle than rusts forming only basidiospores (also called sporidia) and teliospores. The mycelium in the host is intercellular and dikaryotic. The teliospores germinate to form the promycelium where meiosis occurs. Each segment of this promycelium produces haploid basidiospores.

The basidiospores cannot infect and germinate by budding to form yeast like cells. These cells soon fuse with compatible cells to form dikaryotic hyphae, which can infect hosts, wherein it forms dikaryotic mycelium. The mycelium forms teliospores, thereby completing the life cycle.

#### **Kinds of Smut diseases**

The smut disease can be of two types- **Loose smuts** and **Covered smuts**.

A single host may get infected by only one or both types of smuts. All these pathogens are externally seed-borne and do not affect the vegetative growth of the host significantly.

#### **Symptoms of Smut diseases:**

**Loose smuts-** The disease appears when the plant is in inflorescence (ear) stage. In loose smuts, all parts of the florets are converted into smut sori, which are covered by a thin membranous covering. This silvery covering breaks as soon as the smutted head (inflorescence) comes out of the spikelet.

The black powdery mass of spores gets dispersed from the host plant by wind and rain, leaving a naked rachis (stalk) behind. These spores released in the field cause new infections and thus spread disease to healthy plants in field.

Thus in most of the smuts the infection occurs through flowers infecting embryo in the seeds.

**Covered smuts-** In covered smut, the teliospores produced in the cereal grains replace the internal tissues but remain enclosed in a membranous covering of the cereal grains and are not directly exposed to air.

The smutted plants cannot be identified in the field until formation of ears. Smutted ears are hard, compact and usually retained within the sheath for a longer time.

The black teliospores are released only during threshing of the ear due to breaking of the wall of the grain.

Released teliospores become associated externally with the surfaces of the normal grains.

When these contaminated seeds are sown in next season, the teliospores germinate along with them on their seed coats. Thus, the infection in covered smuts is through the seedlings.

The following are common hosts and diseases.

**Disease:** Loose smut of wheat

**Host:** *Triticum aestivum*

**Causal organism:** *Ustilago tritici*

**Disease: Covered Smut of Barley**

**Host:** *Hordeum vulgare*

**Causal organism:** *Ustilago hordei*

*Ustilago nuda* and *Ustilago hordei* infect barley (*Hordeum vulgare*) and cause loose smut and covered smut of barley, respectively.

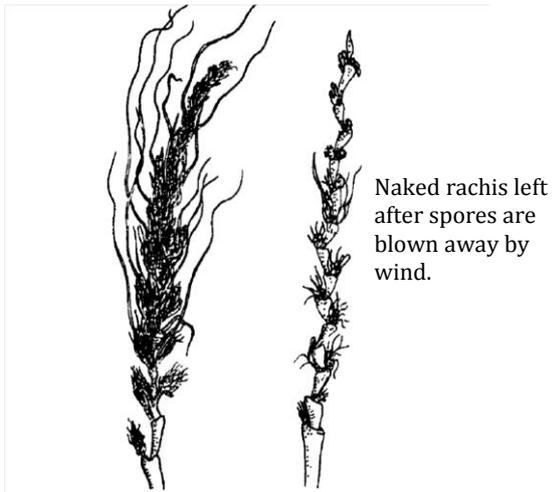
### **Mycelium:**

1. The mycelium is well developed. It is generally intercellular without haustoria but sometimes, it is intracellular also.
2. The mycelium is branched and septate. These are the primary and secondary mycelia.
3. The primary mycelium consists of hyaline, septate hyphae with a single haploid (n) nucleus in each cell. This kind of mycelium is called monokaryotic mycelium or haplomycelium. It is formed by the germination of basidiospores. It becomes dikaryotic when it possesses two nuclei ( $n_1n_2$ ) of different strains in each cell. The primary mycelium soon becomes converted into a secondary mycelium.

### **Reproduction:**

Sex organs are absent in *Ustilago*. Plasmogamy, karyogamy and meiosis do occur.

1. The chlamydospores are formed in the grains of the host by repeated partition of the mycelium.
2. The mature chlamydospores are black soot-like in colour.
3. Each chlamydospore (teliospores) at maturity becomes diploid by karyogamy. The wall is thick with epispore and endospore. Epispore is thick and spiny while endospore is thin and smooth.
4. It germinates to form four basidiospores which in turn produce the monokaryotic (primary) mycelium.

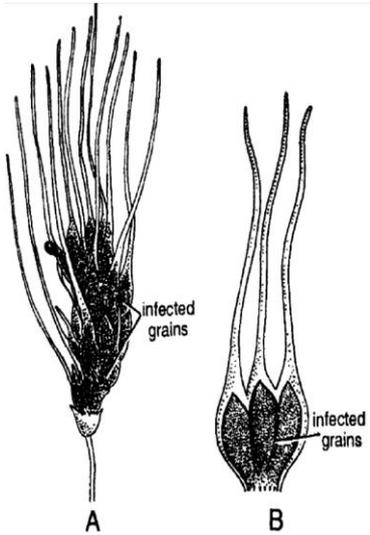


Naked rachis left after spores are blown away by wind.



Smutted ear

**Fig. 1.** *Ustilago*. Loose smut of wheat. Wheat ears infected by *U. tritici*.



Normal ear

**Fig. 2.** *Ustilago*. A. Covered smut of barley. Spike of barley infected by *U. hordei*, B. Spikelet magnified.